

MASTER'S THESIS

Accumulation and transformation of DDT and PCBs by *Phragmites australis* and *Oryza sativa* L.

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**Accumulation and Transformation of DDT and PCBs by
Phragmites australis and *Oryza sativa* L.**

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for the degree of**

Master of Philosophy

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Abstract

DDT (dichlorodiphenyltrichloroethane) and PCBs (polychlorinated biphenyls) are two of the Persistent Organic Pollutants (POPs) in the environment. They are chemical substances that persist in the environment, accumulate through the food web, and pose a risk of causing adverse effects to human health. DDT was used as pesticide in the past but now is banned after the discovery of its persistence and potential toxicological effects to human beings and the environment. PCBs is a class of synthetic chlorinated hydrocarbons characterized by two linked aromatic rings with one to ten chloride substitutes in different positions, which make up of total 209 congeners. PCBs are widely used in industrial process in the past due to their chemical inertness and heat-resistance. After several lethal accidents by PCBs were reported, the production and use of PCBs were banned. Due to their persistence in the environment and the potential risk to human beings, finding methods to remove them from the environment is a concern now, and the use of plants for the removal of such pollutants was suggested as one of the methods. The novelty of the present study is to investigate the ability of *Phragmites australis* (common reed) and *Oryza sativa L.* (rice) to accumulate and transform DDT and PCBs in the hydroponic environment. In this part, results showed that both *Phragmites australis* and *Oryza sativa L.* accumulated DDT and PCBs from hydroponic culture, and the pollutants were mainly accumulated within the roots and the translocation to the upper parts is relatively slow. Only *Phragmites australis* root has the ability to transform DDT into DDD and DDE and the transformation in other parts was not significant. In the accumulation of PCBs, it is believed that the degree of chlorination is the main factor that affects the amount of the uptake by the plants and adsorption is the first step in both DDT and PCB accumulation from hydroponic culture to the plant root. Further more, the potential of the plant crude enzyme extract to degrade and transform DDT and PCBs were also investigated. In this part, results showed that the root enzyme extracts of *Phragmites australis* significantly removed and transformed both DDT and PCBs within the incubation period while *Oryza sativa L.* did not. Chemical inhibition studies proved that the degradation and transformation of both DDT and PCBs by *Phragmites australis* enzymes were partly mediated by peroxidase and plant P-450 system. In addition, the PCBs that with high degree of chlorination were highly resist to degradation and transformation. In summary, results have provided information about the potential of *Phragmites australis* and *Oryza sativa L.* to remove DDT and PCBs from the hydroponic environment and should be useful in further investigation on the in-situ application of plant mediated remediation of persistent organic pollutants in the environment.

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